Calculus C, Homework 2
Due Friday July 16th

Exercise 1. Find the derivatives of the following functions:

$$f(x) = \sin^{-1}(e^x), \tag{1a}$$

$$g(x) = \log(\sin(x)e^x), \tag{1b}$$

$$h(x) = \frac{e^{\sqrt{x}}}{\sqrt{1 + \log(x)^2}}, \tag{1c}$$

$$i(x) = \log|x|. \tag{1d}$$

Can you tell where are these functions defined?

Exercise 2. A woman is at a point A on the shore of a circular lake with radius 2mi and wants to be at the point C diametrically oposed to A, in the shortest time possible. She can walk at the rate of $4mi/h$ and row a boat at a rate of $2mi/h$. At what angle θ to the diameter $\overline{AC}$ should she row?

Exercise 3. Show that of all the isosceles triangles with a given perimeter the one with greatest area is equilateral

Exercise 4. A Boat leaves a dock at 2:00 pm and travels due south at a speed of $20km/h$. Another boat has been heading due east at $15km/h$ and reaches the same dock at 3:00 pm. At what time were the two boats closest together?

Exercise 5. Find the local maximums and minimums of the function $\sin(1/x)$ defined for all $x \neq 0$.

Exercise 6. Find the maximum of the function e^{-x^2} defined for all real x. What about the minimum?

Exercise 7. Two runners start a race at the same time and finish in a tie. Show that at some point they had the same velocity.

Exercise 8. Find the point P in the hyperbola $xy = 8$ that is closest to the point $Q = (3,0)$. Is the line $\overline{PQ}$ tangent to the hyperbola at P?, is it perpendicular to the tangent line at P?